

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on December 23, 2009 has been entered.

This Office action addresses claims 1, 3-5, 7, and 9-31. The previously indicated allowability of claims 1, 3-5, 7, and 9-31 is withdrawn in view of the certified translation of JP 60-230367, now of record. However, it is noted that claim 13 contains allowable subject matter over this reference. Claim 14 has been withdrawn since it remains directed to a nonelected species.

### ***Claim Rejections - 35 USC § 103***

2. Claims 1, 3-5, 7, 9, 10, and 20-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 60-230367.

The reference is directed to a secondary rechargeable battery comprising an electrode (2), a separator, and a counter electrode (4) (see abstract). The electrode (2) comprises a conductive substrate and a nonconductive porous layer contacting the substrate. Regarding claims 1 and 7,

the porous layer may be made of sintered particles of glass or ceramic, which materials are inherently inert to the other cell components (see page 5 of translation). The pore size of the porous layer is between 10 angstroms to 1 millimeter, preferably 100 angstroms to 10 microns. Regarding claims 1, 20 and 21, during battery operation, lithium is precipitated in the bottom of the porous structure, and the electrode (2) inherently functions as a negative electrode (see pages 7 and 8). Regarding claims 9, 10, 26, and 27, the disclosed glasses and ceramics would inherently possess the claimed melting point and thermal conductivity. Regarding claim 22 and 23, the counter electrode may comprise an intercalation metal oxide such as vanadium pentoxide (see page 6).

JP '367 does not expressly teach that the particles have a volume proportion of at least 40%, 50%, or 55%, as recited in claims 1, 24, and 25.

However, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the disclosures of the reference are believed to fairly suggest the claimed porosity ranges. First, it is noted that the reference teaches "sintered" particles, which implies a relatively dense layer of particles. As would be known to a person of skill in the art, sintering is used to densify powder materials and reduce porosity. Accordingly, the disclosure of sintering would suggest high solid volume fractions of one of ordinary skill in the art. Additionally, the reference discloses the additional techniques of chemical erosion, electrolytic oxidation, and ion sputtering directly on the conductive substrate surface to form the porous layer. The disclosure of these techniques is also believed to fairly suggest the use of relatively dense layers which constitute the porous layer. In particular, the "chemical erosion"

technique is believed to be a subtractive etching technique whereby the resulting porosity can be carefully controlled to a relatively low value in the resulting reticulated or matrix-like structure.

Regarding claim 3, although the reference does not specify the shape of the sintered particles, it would be obvious to one of ordinary skill in the art to use generally spherical particles in the nonconductive porous layer.

Regarding claim 4, which recites that the porous structure contains at least two fractions of particles having different average particle sizes, this subject matter would also be rendered obvious. The sizes of the particles can be manipulated to affect packing density, and thus porosity, of the porous layer. Accordingly, it would be obvious to use more than one particle size in the sintered particles.

3. Claims 15-19 and 28-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP '367 as applied to claim 1 above, and further in view of WO 00/44061. Hambitzer et al (U.S. Patent 6,709,789) is taken as an English equivalent of WO '061 herein.

JP '367 does not expressly teach that the electrode comprises particles of a solid salt, as recited in claim 15. Further, JP '367 does not expressly teach that the battery comprises an electrolyte comprising sulfur dioxide, as recited in claim 19.

Hambitzer et al. '789 teach a nonaqueous electrochemical cell having a positive electrode (3), negative electrode (4), and a separator (5). As shown in Figure 2, the negative electrode

comprises a substrate (shown at 4) and a plurality of salt particles (10) located between the separator and the substrate. The salt is preferably an alkali metal halide (see col. 3, line 7). The cell further comprises an electrolyte comprising sulfur dioxide (see col. 6, line 5). A negative active mass, which may comprise Li (see col. 6, line 1 et seq.), is deposited on the substrate and grows into the pores of the salt particles upon charging (see col. 3, line 20). The reference further teaches that the salt particles may be provided on a porous carrier material (18) that is in the form of a “carrier body” or a felt, fleece or fabric (see col. 4, lines 38 and 51).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would first be motivated to incorporate the salt particles of Hambitzer et al. into the porous layer of JP '367. In the abstract, Hambitzer et al. teach that the salt allows the operational safety of the battery to be increased. Accordingly, the artisan would be motivated to incorporate the salt particles of Hambitzer et al. into the porous layer of JP '367.

Regarding claim 16, which recites that the size of the salt particles is much smaller than the solid particles, this subject matter would be rendered obvious based on Hambitzer's disclosure of the salt particles being supported on the inert carrier body, which in JP '367 corresponds to the sintered ceramic particles. Therefore, it would be obvious to use salt particles that are substantially smaller than the sintered ceramic particles. Claims 17, 28, and 29 recite a size ratio of less than 1:2, 1:4, and 1:8, respectively, and would also be rendered obvious. Claims 18, 30, and 31, which recites that the volume of the salt particles is no more than 20%, 10%, or 5%, respectively, of the total solid volume of the porous structure, would also be rendered obvious based on the above considerations in addition to the fact that the skilled artisan

would be guided to maintain the pore sizes of the sintered ceramic particles in the ranges disclosed by JP '367.

Regarding claim 19, it would further be obvious to use the sulfur dioxide electrolyte of Hambitzer et al. in the battery of JP '367. JP '367 provides no particular restriction on its electrolyte composition and in column 6, line 57 et seq., Hambitzer et al. disclose that the sulfur dioxide provides a safety capability by reacting with lithium to form a covering layer of lithium sulfate. Accordingly, the skilled artisan would be motivated to use this material in the electrolyte of JP '367.

4. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP '367 as applied to claim 1 above, and further in view of Aihara et al (2002/0102456).

JP '367 does not expressly teach that the particles comprise a carbide or nitride of silicon, as recited in claims 11 and 12.

Aihara et al. is directed to a nonaqueous battery. In [0072] and [0074], the reference teaches an electrode comprising silicon carbide and silicon nitride powders as a filler.

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention. Accordingly, the use of silicon carbide or silicon nitride as the ceramic of JP '367 would have been obvious to the skilled artisan.

***Allowable Subject Matter***

5. Claim 13 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

6. The following is a statement of reasons for the indication of allowable subject matter:

Claim 13 recites that the porous structure is made of particles which are not bonded to one another. JP '367 discloses "sintered" particles, implying bonded or fused particles, and does not fairly suggest that such particles are not bonded to one another. Accordingly, claim 13 is distinguishable over JP '367. Note: should Applicants amend independent claim 1 to recite the subject matter of claim 13, non-elected claim 14 must be cancelled.

***Conclusion***

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Crepeau whose telephone number is (571) 272-1299. The examiner can normally be reached Monday-Friday from 9:30 AM - 6:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley, can be reached at (571) 272-1453. The phone number for the organization where this application or proceeding is assigned is (571) 272-1700. Documents may be faxed to the central fax server at (571) 273-8300.

Art Unit: 1795

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/Jonathan Crepeau/  
Primary Examiner, Art Unit 1795  
March 25, 2010